This choice of frequency interval is arbitrary; we can also choose the frequency to lie in the interval [0,1). How to choose a unit-length interval for a sinusoid's frequency will become evident later.

5.6.4 Unit Sample

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The second-most important discrete-time signal is the **unit sample**, which is defined to be

$$\delta(n) = \begin{cases} 1 \; if \; n = 0 \\ 0 \; otherwise \end{cases}$$

(5.14)

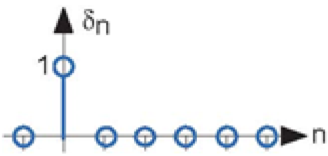

Figure 5.8 The unit sample.

Examination of a discrete-time signal's plot, like that of the cosine signal shown in Figure 5.7(Cosine), reveals that all signals consist of a sequence of delayed and scaled unit samples. Because the value of a sequence at each integer m is denoted by s(*m*) and the unit sample delayed to occur at m is written $\delta(n - m)$, we can decompose **any** signal as a sum of unit samples delayed to the appropriate location and scaled by the signal value.

$$s(n) = \sum_{m=-\infty}^{\infty} (s(m)\delta(n-m))$$

This kind of decomposition is unique to discrete-time signals, and will prove useful subsequently.

5.6.5 Unit Step

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The **unit step** in discrete-time is well-defined at the origin, as opposed to the situation with analog signals.

$$u(n) = \begin{cases} 1 \; if \; n \geq 0 \\ 0 \; if \; n < 0 \end{cases}$$

(5.16)